

Appln No. 10/075,473
Amdt date December 28, 2004
Reply to Office action of November 2, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A method for preparing a positive active material for a rechargeable lithium battery comprising:
mixing a lithium source, a metal source, and a doping liquid comprising a doping element to form a mixture; and
heat-treating the mixture, the heat-treating step comprising:
a first heat-treatment at a temperature ranging from ~~about~~ 400°C to ~~about~~ 500°C;
and
a second heat-treatment at a temperature ranging from ~~about~~ 700°C to ~~about~~ 900°C.
2. (Original) The method according to claim 1, wherein the doping element is selected from the group consisting of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, Zr, Ni, Mn, Cr, Sr, rare earth metals, and mixtures thereof.
3. (Original) The method according to claim 1, wherein the doping liquid comprises a volatile solvent or water.
4. (Original) The method according to claim 1, wherein the doping liquid comprises alcohol.

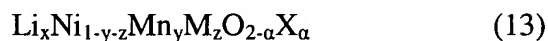
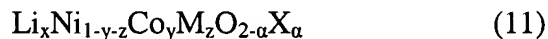
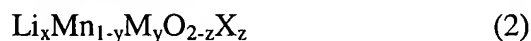
Appln No. 10/075,473

Amdt date December 28, 2004

Reply to Office action of November 2, 2004

5. (Original) The method according to claim 1, wherein the metal source is at least one compound selected from the group consisting of manganese sources, nickel sources, and cobalt sources.

6. (Original) The method according to claim 1, wherein the positive active material is selected from the group consisting of compounds represented by the formulas 1 to 13:



wherein

$$0.95 \leq x \leq 1.1, 0 \leq y \leq 0.5, 0 \leq z \leq 0.5, 0 < \alpha \leq 2;$$

M is selected from the group consisting of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, Zr, Ni, Mn, Cr, Sr, rare earth metals, and mixtures thereof;

A is selected from the group consisting of O, F, S, and P; and

X is selected from the group consisting of F, S, and P.

7. (Canceled)

Appln No. 10/075,473
Amdt date December 28, 2004
Reply to Office action of November 2, 2004

8. (Currently Amended) The method according to claim 1, wherein the first heat treatment is maintained for ~~about~~ 5 hours to ~~about~~ 20 hours; and the second heat treatment is maintained for ~~about~~ 10 hours to ~~about~~ 30 hours.

9. (Canceled)

10. (Currently Amended) A method for preparing a positive active material for a rechargeable lithium battery comprising:

mixing a lithium source; at least one metal source including at least one of a cobalt source, a manganese source, and a nickel source; and a doping liquid comprising a doping element selected from the group consisting of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, Zr, Ni, Mn, Cr, Sr, rare earth metals, and mixtures thereof to form a mixture; and

heat-treating the mixture, the heat-treating ~~step~~ comprising:

a first heat treatment at a temperature ranging from ~~about~~ 400°C to ~~about~~ 500°C;

and

a second heat treatment at a temperature ranging from ~~about~~ 700°C to ~~about~~ 900°C.

11. (Original) The method according to claim 10, wherein the doping liquid comprises a volatile solvent or water.

12. (Original) The method according to claim 10, wherein the doping liquid comprises alcohol.

13. (Original) The method according to claim 10, wherein the positive active material is selected from the group consisting of compounds represented by the formulas 1 to 13:



Appln No. 10/075,473
Amdt date December 28, 2004
Reply to Office action of November 2, 2004

- $\text{Li}_x\text{Mn}_2\text{O}_{4-z}\text{X}_z$ (3)
 $\text{Li}_x\text{Mn}_{2-y}\text{M}_y\text{A}_4$ (4)
 $\text{Li}_x\text{Co}_{1-y}\text{M}_y\text{A}_2$ (5)
 $\text{Li}_x\text{Co}_{1-y}\text{M}_y\text{O}_{2-z}\text{X}_z$ (6)
 $\text{Li}_x\text{Ni}_{1-y}\text{M}_y\text{A}_2$ (7)
 $\text{Li}_x\text{Ni}_{1-y}\text{M}_y\text{O}_{2-z}\text{X}_z$ (8)
 $\text{Li}_x\text{Ni}_{1-y}\text{Co}_y\text{O}_{2-z}\text{X}_z$ (9)
 $\text{Li}_x\text{Ni}_{1-y-z}\text{Co}_y\text{M}_z\text{A}_\alpha$ (10)
 $\text{Li}_x\text{Ni}_{1-y-z}\text{Co}_y\text{M}_z\text{O}_{2-\alpha}\text{X}_\alpha$ (11)
 $\text{Li}_x\text{Ni}_{1-y-z}\text{Mn}_y\text{M}_z\text{A}_\alpha$ (12)
 $\text{Li}_x\text{Ni}_{1-y-z}\text{Mn}_y\text{M}_z\text{O}_{2-\alpha}\text{X}_\alpha$ (13)

wherein

$$0.95 \leq x \leq 1.1, 0 \leq y \leq 0.5, 0 \leq z \leq 0.5, 0 < \alpha \leq 2;$$

M is selected from the group consisting of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, Zr, Ni, Mn, Cr, Sr, rare earth metals, and mixtures thereof;

A is selected from the group consisting of O, F, S, and P; and

X is selected from the group consisting of F, S, and P.

14. (Canceled)

15. (Currently Amended) The method according to claim 10, wherein the first heat treatment is maintained for ~~about~~ 5 hours to ~~about~~ 20 hours; and the second heat treatment is maintained for ~~about~~ 10 hours to ~~about~~ 30 hours.

16. (Canceled)

17. (Currently Amended) A method for preparing a positive active material for a rechargeable lithium battery comprising:

Appln No. 10/075,473
Amdt date December 28, 2004
Reply to Office action of November 2, 2004

mixing a lithium source; at least one metal source including at least one of a cobalt source, a manganese source, and a nickel source; and an Al-including doping liquid or a B-including doping liquid to form a mixture; and

heat-treating the mixture, the heat-treating step comprising:

a first heat treatment at a temperature ranging from about 400°C to about 500°C;

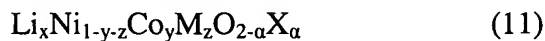
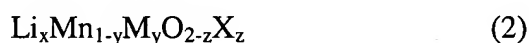
and

a second heat treatment at a temperature ranging from about 700°C to about 900°C.

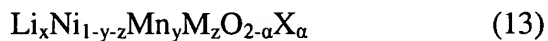
18. (Original) The method according to claim 17, wherein the doping liquid comprises a volatile solvent or water.

19. (Original) The method according to claim 17, wherein the doping liquid comprises alcohol.

20. (Original) The method according to claim 17, wherein the positive active material is selected from the group consisting of compounds represented by the formulas 1 to 13:



Appln No. 10/075,473
Amdt date December 28, 2004
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wherein

$$0.95 \leq x \leq 1.1, 0 \leq y \leq 0.5, 0 \leq z \leq 0.5, 0 < \alpha \leq 2;$$

M is selected from the group consisting of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, Zr, Ni, Mn, Cr, Sr, rare earth metals, and mixtures thereof;

A is selected from the group consisting of O, F, S, and P; and

X is selected from the group consisting of F, S, and P.

21. (Canceled)

22. (Currently Amended) The method according to claim 17, wherein the first heat treatment is maintained for ~~about~~ 5 hours to ~~about~~ 20 hours; and the second heat treatment is maintained for ~~about~~ 10 hours to ~~about~~ 30 hours.

23. (Canceled)

24. (Original) The method according to claim 17, wherein the metal source is a cobalt source, and the doping liquid is an Al-including doping liquid.

25. (Original) The method according to claim 17, wherein the metal source is a manganese source or a nickel source, and the doping liquid is an Al-including doping liquid.

26. (Original) The method according to claim 17, wherein the metal source is a manganese source or a nickel source, and the doping liquid is a B-including doping liquid.